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WHAT IS CLAIMED IS:

1. A rotatable tool for friction stir welding a workpiece, the tool comprising:

a first pin portion structured to extend longitudinally from a shoulder, the first pin portion defining a contour surface opposite the shoulder; and

a second pin portion extending longitudinally from the contour surface of the first pin portion, the second portion having a width in a transverse direction that is smaller than a width of the first pin portion,

wherein the contour surface of the first pin portion defines at least one ridge extending in a spiral configuration.

2. A tool according to Claim 1 wherein the ridge of the contour surface extends in a continuous spiral configuration from the second pin portion to an outer diameter of the contour surface.

3. A tool according to Claim 1 wherein the first pin portion defines a cylindrical outer surface.

4. A tool according to Claim 1 wherein the second pin portion is tapered in the longitudinal direction away from the contour surface.

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5. A tool according to Claim 1 wherein the second pin portion defines at least one feature extending radially therefrom.

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6. A tool according to Claim 1 wherein the second pin portion defines a generally helical thread extending from an outer surface thereof.

7. A tool according to Claim 1 wherein the first pin portion defines a length in the longitudinal direction corresponding substantially to a thickness of a first structural member of the workpiece.

8. A tool according to Claim 1 wherein the contour surface is generally parallel to the shoulder.

9. An apparatus for forming a friction stir weld lap joint in a workpiece including first and second structural portions in a lap configuration and defining an interface therebetween, the apparatus comprising:

a rotatable tool having a shoulder, a first pin portion, and a second pin portion, the first pin portion extending longitudinally from the shoulder and having opposite the shoulder a contour surface defining at least one ridge extending in a spiral configuration, the second pin portion extending longitudinally from the contour surface and having a width in a transverse direction that is smaller than a width of the first pin portion; and

an actuator connected to the tool and configured to rotate the tool and urge the tool in a longitudinal direction substantially perpendicular to the interface such that the shoulder is urged against the workpiece, the first pin portion pin extends at least partially through the first structural portion, the second pin portion extends at least partially through the second structural portion, the first and second pin portions thereby plasticizing a portion of the workpiece and forming a friction stir weld lap joint therein.

10. An apparatus according to Claim 9 wherein the ridge of the contour surface extends in a continuous spiral configuration from the second pin portion to an outer diameter of the contour surface.

11. An apparatus according to Claim 9 wherein the first pin portion defines a cylindrical outer surface.

12. An apparatus according to Claim 9 wherein the second pin portion is tapered in the longitudinal direction away from the contour surface.

13. An apparatus according to Claim 9 wherein the second pin portion defines at least one feature extending radially therefrom.

14. An apparatus according to Claim 9 wherein the second pin portion defines a generally helical thread extending from an outer surface thereof.

15. An apparatus according to Claim 9 wherein the first pin portion defines a length in the longitudinal direction corresponding substantially to a thickness of the first structural portion of the workpiece such that the contour surface is disposed within about 0.050 inch from the interface when the shoulder is urged against the first structural portion.

16. An apparatus according to Claim 9 wherein the first pin portion defines a length in the longitudinal direction corresponding substantially to a thickness of the first structural portion of the workpiece such that the contour surface is disposed within about 0.030 inch from the interface when the shoulder is urged against the first structural portion.

17. An apparatus according to Claim 9 wherein the contour surface is generally parallel to the shoulder.

18. An apparatus according to Claim 9 wherein the shoulder defines a contour surface for frictionally engaging the workpiece.

19. A method for forming a friction stir weld lap joint in a workpiece, the method comprising:

positioning at least one structural member in an overlapping configuration to define an interface between a first structural portion and a second structural portion;

rotating a friction stir welding tool defining a shoulder and a pin extending therefrom; and

urging the friction stir welding tool in a longitudinal direction substantially perpendicular to the interface such that the pin extends through the interface with a first portion of the pin extending longitudinally from the shoulder at least partially through the first structural portion to a contour surface of the first pin portion defining at least one ridge extending in a spiral configuration, a second portion of the pin extending longitudinally from a contour surface of the first pin portion at least partially through the second structural portion such that the first and second pin portions thereby plasticize a portion of the workpiece and form a friction stir weld joint therein.

20. A method according to Claim 19 wherein said rotating and urging steps comprise mixing the plasticized portion of the workpiece with a ridge on the contour surface extending in a continuous spiral configuration from the second pin portion to an outer diameter of the contour surface.

21. A method according to Claim 19 wherein said rotating and urging steps comprise mixing the plasticized portion of the workpiece with at least one feature extending radially from the second pin portion.

22. A method according to Claim 19 wherein said urging step comprises urging the shoulder against the first structural portion such that the contour surface is disposed within about 0.050 inch from the interface.

23. A method according to Claim 19 wherein said urging step comprises urging the shoulder against the first structural portion such that the contour surface is disposed within about 0.030 inch from the interface.

24. A method according to Claim 19 further comprising providing the workpiece, the workpiece comprising at least one of the group consisting of aluminum, aluminum alloys, titanium, titanium alloys, copper, copper alloys, magnesium, magnesium alloys, and ferrous alloys.